

PROGRAM OUTLINE

Roofer

(Roofer, Damp and Waterproofer)



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ROOFER, DAMP AND WATERPROOFER PROGRAM OUTLINE

**APPROVED
DECEMBER 2012**

**BASED ON
NOA 2012**

Developed by
Industry Training Authority
Province of British Columbia



TABLE OF CONTENTS

Section 1 INTRODUCTION.....	3
Foreword	4
Acknowledgements	5
How to Use this Document.....	6
Section 2 PROGRAM OVERVIEW	8
Program Credentialing Model	9
Occupational Analysis Chart	10
Training Topics and Suggested Time Allocation.....	12
Section 3 PROGRAM CONTENT	16
Level 1 Roofer, Damp and Waterproofer	17
Level 2 Roofer, Damp and Waterproofer	66
Level 3 Roofer, Damp and Waterproofer	94
Section 4 TRAINING PROVIDER STANDARDS	121
Facility Requirements.....	122
Tools and Equipment	123
Reference Materials	126
Instructor Requirements.....	132
Appendix A Assessment Guidelines	133



Section 1

INTRODUCTION

Roofer, Damp and Waterproofer



Foreword

This revised Roofer, Damper and Waterproofer Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies, and provincial and federal governments. It reflects updated standards based on the British Columbia industry and subject matter experts.

Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship.

This Program Outline includes a list of recommended reference textbooks that are available to support the learning objectives and the minimum shop requirements needed to support instruction.

The Program Outline was prepared with the advice and assistance of the Roofer, Damper and Waterproofer Review Committee and will form the basis for further updating of the British Columbia Roofer, Damper and Waterproofer Program and learning resources by the BC Safety Authority on behalf of the Industry Training Authority (ITA).

Each competency is to be evaluated through the use of written examination in which the learner must achieve a minimum of 70% in order to receive a passing grade. The types of questions used on these exams must reflect the cognitive level indicated by the learning objectives and the learning tasks listed in the related competencies.

Achievement Criteria are included for those competencies that require a practical component. The intent of including Achievement Criteria in the program outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measureable and that they reflect the skills spelled out in the competency as those required of a competent journeyman. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the level of expectation of success.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

SAFETY ADVISORY

Be advised that references to the WorkSafe BC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: <http://www.worksafebc.com>. Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.



Acknowledgements

The Program Outline was prepared with the advice and direction of an 2012 industry steering committee convened initially by the Construction Industry Training Organization (CITO). Members include:

- Shirley Caldwell
- Len Dewit
- Darren Light
- Howard Schlamb
- Ivan van Spronsen
- Graham Wilferd

Industry subject matter experts retained to assist in the development of 2007 Program Outline content:

- Shirley Caldwell
- Alex Goldie
- Ross Laing
- Rod Parker
- David Rice
- Howard Schlamb
- Roger Sové

Industry subject matter experts retained as 2012 outline reviewers:

- Simone Ballard
- Dan Ogilvie
- Roy Olsen
- David Rice
- Roger Sové
- Callum Walsh

The Industry Training Authority would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the roofer, damp and waterproofer occupation.



How to Use this Document

This Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Program Credentialing Model	Communicate program length and structure, and all pathways to completion	Understand the length and structure of the program	Understand the length and structure of the program, and pathway to completion	Understand challenger pathway to Certificate of Qualification
Program Assessment	Communicate program completion requirements and assessment methods	Understand the various assessment requirements for the program	Understand the various assessment requirements for the program	Understand the assessment requirements they would have to fulfill in order to challenge the program
OAC	Communicate the competencies that industry has defined as representing the scope of the occupation	Understand the competencies that an apprentice is expected to demonstrate in order to achieve certification	View the competencies they will achieve as a result of program completion	Understand the competencies they must demonstrate in order to challenge the program
Training Topics and Suggested Time Allocation	Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application	Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Understand the relative weightings of various competencies of the occupation on which assessment is based
Program Content	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measurable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice	Provides detailed information on program content and performance expectations for demonstrating competency	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels



Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Training Provider Standards	Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program	Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own	Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors	Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment



Section 2

PROGRAM OVERVIEW

Roofer, Damp and Waterproofer

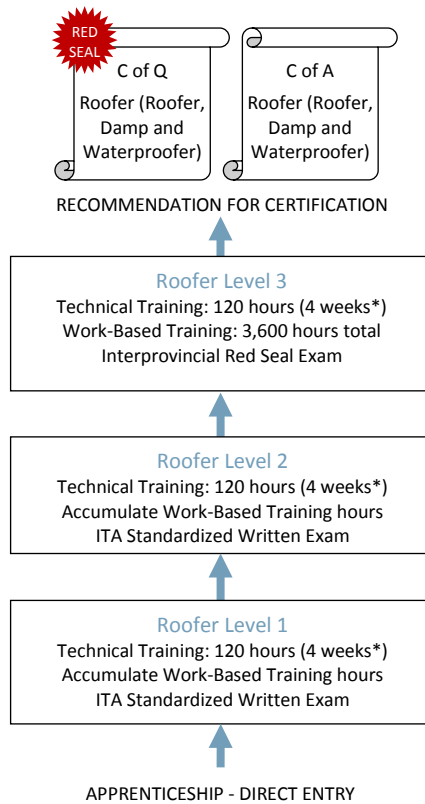


Program Credentialing Model

Apprenticeship Pathway

This graphic provides an overview of the Roofer (Roofer, Damp and Waterproofer) apprenticeship pathway.

C of Q = Certificate of Qualification
 C of A = Certificate of Apprenticeship



CROSS-PROGRAM CREDITS

Individuals who hold the credentials listed below are entitled to receive partial credit toward the completion requirements of this program

None



Occupational Analysis Chart

ROOFER, DAMP AND WATERPROOFER

Roofer, Damp and Waterproofer description: “Roofer” means a person who builds or lays insulation, vapour retarders, built-up or flat-deck roofs, covering roof frames with unitized materials such as tile, slate, composite, wood, shakes and shingles and metal shingles; application of roof deck waterproofing with modern plastic and rubberized coating materials and, the damp and waterproofing of floors, foundations and below-grade pipes and tanks with such materials as pitch, tar, asphalt, plastic, bitumen and rubberized materials, in any building other than residential premises.

Use Safe Work Practices A	Describe Workplace Hazards A1	Interpret the Occupational Health and Safety Regulation and WCB Standards A2	Use WHMIS A3	Use Personal Protective Equipment A4	Use Fire Safety Procedures A5		
	1 2 3	1	1 2 3	1 2 3	1 2		
	Use Tools and Equipment B	Use Hand Tools B1	Use Portable Power Tools B2	Use Propane Fuelled Equipment B3	Use Hot Process Equipment B4	Use Hoisting, Lifting and Rigging Equipment B5	Use Motorized Equipment B6
		1	1	1	1	1	1
		Use Documentation C	Use Ladders and Platforms B7	Read Drawings and Specifications C1	Use Building Codes and RCABC Standards C2	Read Manufacturers' Information C3	
1	2 3		1 2 3	1 2 3			



Program Overview

Organize Work D	Describe Roof Types D1	Communicate With Others D2	Prepare The Worksite D3	Estimate Quantities Of Materials D4		
	1	1	1	1 2 3		
Prepare Roofs E	Prepare Roofs For Replacement E1	Prepare Roofs For New Installation E2				
	1	1				
Install Low Slope and Flat Roofing F	Install Gypsum Board and Insulation F1	Install Overlay Board F2	Install Vapour Retarders and Air Barriers F3	Install Flashing Materials F4	Install Built-Up Roofing Systems F5	Install Flexible Membrane Roof Systems F6
	1 2 3	1 2 3	1 3	1 2 3	1 3	2 3
Install Steep Roofing G	Install Asphalt Shingles G1	Install Wood Shingles and Shakes G2	Install Concrete and Composite Materials G3	Install Metallic Materials G4		
	1	2	2	2 3		
Assess and Maintain Roofs, Damp and Waterproofing H	Assess Roof Conditions H1	Maintain and Repair Roofs, Damp and Waterproofing H2				
	3	3				
Apply Waterproofing and Damp-Proofing I	Waterproof Surfaces I1	Damp-Proof Surfaces I2				
	2	2				



Training Topics and Suggested Time Allocation

ROOFER, DAMP AND WATERPROOFER – LEVEL 1

		% of Time Allocated to:			
		% of Time	Theory	Practical	Total
Line A	Use Safe Work Practices	17%	83%	17%	100%
A1	Describe Workplace Hazards		✓		
A2	Interpret The Occupational Health and Safety Regulation and WCB Standards		✓		
A3	Use WHMIS		✓		
A4	Use Personal Protective Equipment		✓	✓	
A5	Use Fire Safety Procedures		✓		
Line B	Use Tools and Equipment	18%	70%	30%	100%
B1	Use Hand Tools		✓		
B2	Use Portable Power Tools		✓		
B3	Use Propane Fuelled Equipment		✓		
B4	Use Hot Process Equipment		✓	✓	
B5	Use Hoisting, Lifting and Rigging Equipment		✓	✓	
B6	Use Motorized Equipment		✓		
B7	Use Ladders and Platforms		✓	✓	
Line C	Use Documentation	7%	100%	0%	100%
C2	Use Building Codes and RCABC Standards		✓		
C3	Read Manufacturers' Information		✓		
Line D	Organize Work	20%	100%	0%	100%
D1	Describe Roof Types		✓		
D2	Communicate With Others		✓		
D3	Prepare the Worksite		✓		
D4	Estimate Quantities Of Materials		✓		
Line E	Prepare Roofs	3%	100%	0%	100%
E1	Prepare Roofs For Replacement		✓		
E2	Prepare Roofs For New Installation		✓		
Line F	Install Low Slope and Flat Roofing	20%	100%	0%	100%
F1	Install Gypsum Board and Insulation		✓		
F2	Install Overlay Board		✓		
F3	Install Vapour Retarders and Air Barriers		✓		
F4	Install Flashing Materials		✓		
F5	Install Built-Up Roofing Systems		✓		



		% of Time Allocated to:			
		% of Time	Theory	Practical	Total
Line G G1	Install Steep Roofing	15%	50%	50%	100%
	Install Asphalt Shingles		✓	✓	
Total Percentage for Roofer Level 1		100%			

The composite level mark is to consist of 70% theory and 30% practical.
 The final exam will count for 20% of the theory mark.



Training Topics and Suggested Time Allocation

ROOFER, DAMP AND WATERPROOFER – LEVEL 2

		% of Time	% of Time Allocated to:		
			Theory	Practical	Total
Line A	Use Safe Work Practices	12%	75%	25%	100%
A1	Describe Workplace Hazards		✓		
A4	Use Personal Protective Equipment		✓		
A5	Use Fire Safety Procedures		✓	✓	
Line C	Use Documentation	13%	100%	0%	100%
C1	Read Drawings and Specifications		✓		
C2	Use Building Codes and RCABC Standards		✓		
C3	Read Manufacturers' Information		✓		
Line D	Use Documentation	11%	50%	50%	100%
D4	Estimate Quantities Of Materials		✓	✓	
Line F	Install Low Slope and Flat Roofing	37%	80%	20%	100%
F1	Install Gypsum Board and Insulation		✓		
F2	Install Overlay Board		✓		
F4	Install Flashing Materials		✓		
F6	Install Flexible Membrane Roof Systems		✓	✓	
Line G	Install Steep Roofing	21%	75%	25%	100%
G2	Install Wood Shingles and Shakes		✓	✓	
G3	Install Concrete and Composite Materials		✓		
G4	Install Metallic Materials		✓		
Line I	Apply Waterproofing and Damp-Proofing	6%	100%	0%	100%
I1	Waterproof Surfaces		✓		
I2	Damp-Proof Surfaces		✓		
Total Percentage for Roofer Level 2		100%			

The composite level mark is to consist of 70% theory and 30% practical.

The final exam will count for 20% of the theory mark.



Training Topics and Suggested Time Allocation

ROOFER, DAMP AND WATERPROOFER – LEVEL 3

		% of Time	% of Time Allocated to:		
			Theory	Practical	Total
Line A	Use Safe Work Practices	8%	100%	0%	100%
A1	Describe Workplace Hazards		✓		
A4	Use Personal Protective Equipment		✓		
Line C	Use Documentation	7%	100%	0%	100%
C1	Read Drawings and Specifications		✓		
C2	Use Building Codes and RCABC Standards		✓		
C3	Read Manufacturers' Information		✓		
Line D	Organize Work	7%	100%	0%	100%
D4	Estimate Quantities Of Materials		✓		
Line F	Install Low Slope and Flat Roofing	58%	75%	25%	100%
F1	Install Gypsum Board and Insulation		✓		
F2	Install Overlay Board		✓		
F3	Install Vapour Retarders and Air Barriers		✓		
F4	Install Flashing Materials		✓	✓	
F5	Install Built-Up Roofing Systems		✓		
F6	Install Flexible Membrane Roof Systems		✓	✓	
Line G	Install Steep Roofing	10%	100%	0%	100%
G4	Install Metallic Materials		✓		
Line H	Assess and Maintain Roofs, Damp and Waterproofing	10%	100%	0%	100%
H1	Assess Roof Conditions		✓		
H2	Maintain and Repair Roofs, Damp and Waterproofing		✓		
Total Percentage for Roofer Level 3		100%			

The composite level mark is to consist of 70% theory and 30% practical.

The final exam will count for 20% of the theory mark.



Section 3

PROGRAM CONTENT

Roofer, Damp and Waterproofer



Level 1

Rofer, Damp and Waterproofer



- 4. Locate emergency equipment and means of egress
 - Emergency shutoffs
 - Fire control systems
 - Emergency exits
 - First aid facilities
 - Emergency contacts/phone numbers
 - Muster station

- 5. Describe hazards in the roofing industry
 - Falls
 - Ladders
 - Debris
 - Fire
 - Electrical
 - Lockout procedures
 - Compressed gas
 - Fuels (liquid and gaseous)
 - Hot Asphalt
 - Alcohol
 - Drugs
 - Lifting
 - Personal apparel
 - Clothing
 - Hair and beards
 - Jewellery
 - Housekeeping
 - Horseplay
 - Respect for others safety
 - Constant awareness of surroundings
 - Working below grade



Line (GAC): A Use Safe Work Practices
Competency: A2 Interpret the Occupational Health and Safety Regulation and WCB Standards

Objectives

To be competent in this area the individual must be able to:

- Describe the application of the parts of the Workers’ Compensation Act outlined in the Occupational Health and Safety Regulations.
- Locate and apply the Parts of the Occupational Health and Safety Regulation as it applies to the Roofers’ workplace.

LEARNING TASKS

CONTENT

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Define terms used in the Workers’ Compensation Act 2. Describe the conditions under which compensation will be paid 3. Describe the general duties of employers, employees and others 4. Describe the Workers’ Compensation Act requirements for the reporting of accidents 5. Describe the “Core Requirements” of the Occupational Health and Safety Regulation | <ul style="list-style-type: none"> • Definitions, Section 1 of the Act
 • Part 1, Division 2 of the Act
 • Part 2, Division 3, Sections 115-124 of the Act
 • Part1, Division 5, Sections 53 and 54 of the Act
 • Definitions • Application • Rights and Responsibilities <ul style="list-style-type: none"> ○ Health and safety programs ○ Investigations and reports ○ Workplace inspections ○ Right to refuse work • General Conditions <ul style="list-style-type: none"> ○ Building and equipment safety ○ Emergency preparedness ○ Preventing violence ○ Working alone ○ Ergonomics ○ Illumination ○ Indoor air quality ○ Smoking and lunchrooms |
|---|--|



6. Locate the “General Hazard Requirements” of the Occupational Health and Safety Regulation
 - Chemical and biological substances
 - Substance specific requirements
 - Noise, vibration, radiation and temperature
 - Personal protective clothing and equipment
 - Confined spaces
 - De-energization and lockout
 - Fall protection
 - Tools, machinery and equipment
 - Ladders, scaffolds and temporary work platforms
 - Cranes and hoists
 - Rigging
 - Mobile equipment
 - Transportation of workers
 - Traffic control
 - Electrical safety



Line (GAC): A Use Safe Work Practices

Competency: A3 Use WHMIS

Objectives

To be competent in this area the individual must be able to:

- Describe the purpose of the Workplace Hazardous Materials Information System (WHMIS) Regulations.
- Explain the contents of material safety data sheets (MSDS).
- Explain the contents of a WHMIS label.
- Apply WHMIS regulations.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Describe the legislation that requires suppliers of hazardous materials to provide MSDSs and label products as a condition of sale and importation
 2. Describe the purpose of the Workplace Hazardous Materials Information System (WHMIS)
 3. Describe the key elements of WHMIS
 4. Describe the responsibilities of suppliers under WHMIS
 5. Describe the responsibilities of employers under WHMIS | <ul style="list-style-type: none"> • Hazardous Product Act • Controlled Products Regulations • Ingredient Disclosure List • Hazardous Materials Information Review Act • Hazardous Materials Information Review Regulations
 • Protection of Canadian workers from the adverse effects of hazardous materials through the provision of relevant information while minimizing the economic impact on industry and the disruption of trade • Recognition of rights <ul style="list-style-type: none"> ○ Workers ○ Employers ○ Suppliers ○ Regulators
 • Material safety data sheets (MSDSs) • Labelling of containers of hazardous materials • Worker education programs
 • Provide <ul style="list-style-type: none"> ○ MSDSs ○ Labels
 • Provide <ul style="list-style-type: none"> ○ MSDSs ○ Labels ○ Work education programs in the workplace |
|---|---|



- | | |
|---|--|
| <p>6. Describe information to be disclosed on a MSDS</p> | <ul style="list-style-type: none"> • Hazardous ingredients • Preparation information • Product information • Physical data • Fire or explosion • Reactivity data • Toxicological properties • Preventive measures • First-aid measures |
| <p>7. Identify symbols found on WHMIS labels and their meaning</p> | <ul style="list-style-type: none"> • Compressed gases • Flammable and combustible materials • Oxidizing materials • Poisonous and infectious materials <ul style="list-style-type: none"> ○ Materials Causing Immediate and Serious Toxic Effects ○ Materials Causing Other Toxic Effects ○ Biohazardous Infectious Materials • Corrosive Materials • Dangerously Reactive Materials |
| <p>8. Apply WHMIS regulations as they apply to hazardous materials used on site</p> | <ul style="list-style-type: none"> • Use, storage and disposal of |



Achievement Criteria:

- Performance** The individual will set-up and use appropriate safety procedures on the site.
- Conditions** The individual will be given:
- Safety equipment
 - Standards and Regulations
- Criteria** The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Selection and use of equipment
 - Maintenance and storage of equipment



Line (GAC): A Use Safe Work Practices

Competency: A5 Use Fire Safety Procedures

Objectives

To be competent in this area the individual must be able to:

- Describe the conditions necessary to support a fire.
- Describe classes of fires and methods used to extinguish them.
- Describe the considerations and steps taken prior to deciding to fight a fire.
- Select and use appropriate fire extinguishers.
- Describe fire prevention strategies.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Describe the conditions necessary to support a fire
 2. Describe the classes of fires according to the materials being burned
 3. Describe kinds of fire extinguishers
 4. Describe the use of fire extinguishers
 5. Describe the considerations and steps to be taken prior to fighting a fire | <ul style="list-style-type: none"> • Air • Fuel • Heat
 • Class A • Class B • Class C • Class D
 • Water • Foam • Soda acid • CO₂ • Dry chemical • Halons
 • Extinguisher selection <ul style="list-style-type: none"> ○ Class A ○ Class B ○ Class C ○ Class D • P.A.S.S. <ul style="list-style-type: none"> ○ Pull ○ Aim ○ Squeeze ○ Sweep
 • Warning others and the fire department • Evacuation of others • Fire contained and not spreading • Personal method of egress • Training |
|---|---|



6. Describe fire prevention techniques
 - Kettles and tankers
 - Gas and fuels
 - Solvents
 - Storage and handling
 - Application techniques



Line (GAC): B Use Tools and Equipment
Competency: B1 Use Hand Tools

Objectives

To be competent in this area the individual must be able to:

- Select hand tools appropriate to roofing processes.
- Use and maintain hand tools.

LEARNING TASKS

CONTENT

1. Describe roofing hand tools

- Knives
- Snips
- Hatchet
- Staple hammer
- Saws
- Screwdrivers
- Hammers
- Pry bars
- Chalk lines
- Measuring tapes
- Crescent wrenches
- Shovels
- Spudders
- Scrapers
- Wheelbarrow

2. Use roofing hand tools

- Types
- Parts
- Purpose/Uses
- Selection
- Procedures/Operations
- Safety
- Adjustment
- Inspection
- Maintenance
 - Sharpening
 - Lubrication
 - Filing
- Storage



Line (GAC): B Use Tools and Equipment

Competency: B2 Use Portable Power Tools

Objectives

To be competent in this area the individual must be able to:

- Select portable power tools appropriate to roofing applications.
- Use and maintain portable power tools.

LEARNING TASKS

1. Describe roofing power tools

CONTENT

- Circular saws
- Drills
- Chain saws
- Angle grinders
- Screw guns
- Masonry saws
- Electric motors
- Powder-actuated tools
- Pneumatic tools
- Sweepers
- Spudding machine
- Gravel spreaders
- Roof cutter
- Sprayers

2. Use roofing power tools

- Types
- Parts
- Purpose/Uses
- Procedures/Operations
- Safety
- Adjustment
- Inspection
- Maintenance
- Lubrication
- Tensioning
- Refuelling
- Filter replacement
- Storage



Line (GAC): B Use Tools and Equipment
Competency: B3 Use Propane Fuelled Equipment

Objectives

To be competent in this area the individual must be able to:

- Describe propane fuelled equipment and related safety procedures.
- Use propane fuelled equipment.

LEARNING TASKS

1. Describe propane fuelled equipment

2. Use propane fuelled equipment

CONTENT

- Types
- Purpose

- Types of bottles
 - Liquid
 - Vapour
- Certification requirements
- Handling procedures
- Transportation procedures and regulations
- Connecting and disconnecting
- Inspection
 - Lines
 - Valves
 - Couplers
 - Regulators
- Maintenance
- Storage



Line (GAC): B Use Tools and Equipment

Competency: B4 Use Hot Process Equipment

Objectives

To be competent in this area the individual must be able to:

- Select hot process equipment appropriate to the task.
- Use and maintain hot process equipment.

LEARNING TASKS

1. Describe hot process equipment

2. Use hot process equipment

CONTENT

- Felt layer
- Mini-mop
- Taping machine
- Hot carrier
- Kettles (pumper and hot rubber)
- Tankers
- Pumps and piping

- Types
- Parts
- Purpose/Uses
- Operating procedures
- Safety
 - Equiviscous and flashpoint temperatures
- Moisture checks
- Bitumen kept clean
- Hot supply line (Piping)
- Adjustment
- Inspection
- Maintenance
- Handling fuels and sources
- Storage



Achievement Criteria:

Performance The individual will set-up and operate a kettle.

Conditions The individual will be given:

- Kettle
- Hand tools
- Fuel
- Personal protective equipment
- Location of fire safety equipment
- Operating instructions

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:

- Follows proper procedures
- Location
- Safety
- Barricading
- Signage



- 3. Describe rooftop delivery systems
 - Maintenance
 - Storage
 - Types
 - Cranes
 - Hyabs
 - Conveyors
 - Uses
 - Limitations/Ratings/Specifications
 - Parts
 - Inspection
 - Maintenance
 - Storage
- 4. Describe roof top storage practices
 - Load distribution and location
 - Material handling
- 5. Use rigging and hoisting equipment
 - Safety
 - Regulations
 - Manufacturers' specifications
 - Training and certification requirements
 - Operating procedures
 - Roof protection from equipment
 - Estimating Loads and heights
 - Load distribution
 - Load limits
 - Ropes
 - Cables
 - Chains
 - Slings
 - Hooks
 - Shackles
 - Spreader bars
 - Knots
 - Selection
 - Tying
 - Hand signals
 - Stop
 - Lower and raise
 - Boom in and out
 - Travel
 - Dog everything
 - Radio communications
 - Precautions
 - Slings
 - Tag lines



- Power lines
- Knots
- Equipment specifications
- Erection/set-up
- Dismantling
- Loading
- Unloading
- Weight distribution
- Securing loads
- Inspection
- Maintenance
- Storage

Achievement Criteria:

Performance	The individual will set-up and operate a ladder hoist.
Conditions	<p>The individual will be given:</p> <ul style="list-style-type: none"> ● A ladder hoist ● Material to be lifted ● Operating instructions
Criteria	<p>The individual will score 70% or better on a rating sheet that reflects the following criteria:</p> <ul style="list-style-type: none"> ● Inspection of equipment ● Safety ● Operating procedures ● Assembly and disassembly ● Barricading ● Signage



- 2 Performance The individual will set-up and operate a hydraulic hoist.
- Conditions The individual will be given:
- A hydraulic hoist
 - Materials to be lifted
 - Operation instructions
- Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Inspection of equipment
 - Safety
 - Operating procedures
 - Assembly and disassembly
 - Barricading
 - Signage
 - Tag lines



Line (GAC): B Use Tools and Equipment

Competency: B6 Use Motorized Equipment

Objectives

To be competent in this area the individual must be able to:

- Describe motorized equipment and its purposes.
- Use and maintain motorized equipment.

LEARNING TASKS

1. Describe motorized equipment

2. Use motorized equipment

CONTENT

- Types
 - Power buggies
 - Roof cutters
 - Asphalt spreaders
 - Gravel spreaders
 - Roof sweeper
- Manufacturers' specifications and requirements
- Types
- Parts
- Purpose/Uses
- Operating procedures
- Limitations
- Safety
- Adjustment
- Inspection
- Maintenance
- Storage



Achievement Criteria:

Performance	The individual will assemble, use and disassemble steel scaffolding.
Conditions	The individual will be given: <ul style="list-style-type: none">• Scaffolding• Level• Fall protection equipment
Criteria	The individual will score 70% or better on a rating sheet that reflects the following criteria: <ul style="list-style-type: none">• Equipment inspection• Level• Plumb• Assembled to specification• Accessing• Use of fall protection



Line (GAC): **C Use Documentation**
Competency: **C2 Use Building Codes and RCABC Standards**

Objectives

To be competent in this area the individual must be able to:

- Locate and interpret sections of the provincial and national building codes that apply to the roofing trade.
- Describe guarantee program recommendations that exceed the requirements of other codes.
- Describe municipal requirements that supersede or amend the provincial building codes.

LEARNING TASKS

CONTENT

- | | |
|--|---|
| 1. Interpret the BC and National Building Codes | <ul style="list-style-type: none"> • Sections • Materials • Flashing • Eaves • Bearing walls • Trusses and rafters • Decking • Insulation and weatherproofing • Installation • Loads • Differences between the codes |
| 2. Identify municipal code requirements for roofing | <ul style="list-style-type: none"> • Loads (esp. snow) • Materials • Permits • Inspections |
| 3. Describe guarantee programs which exceed the BC and National Building Codes | <ul style="list-style-type: none"> • CSA/ISO • RCABC (RGC) • Manufacturers |



Line (GAC): **C Use Documentation**
Competency: **C3 Read Manufacturers' Information**

Objectives

To be competent in this area the individual must be able to:

- Interpret manufacturers' instructions and specifications.

LEARNING TASKS

1. Interpret roofing system manufacturers' specifications

2. Use roofing system manufacturers' application procedures

CONTENT

- Manufacturers' specifications
- Manufacturers' installation instructions
- Manufacturers' inspection and maintenance information
- Manufacturers' troubleshooting documentation

- Installation
- Fastening methods
- Handling
- Storage
- Overlaps
- Minimums/maximums



Line (GAC): **D Organize Work**
Competency: **D1 Describe Roof Types**

Objectives

To be competent in this area the individual must be able to:

- Describe types of roof structures and designs.
- Describe roof structural components.
- Perform roof slope calculations.

LEARNING TASKS

CONTENT

- | | |
|--|---|
| 1. Identify types of roof structures and designs | <ul style="list-style-type: none"> • Hip • Gable • Gambrel • A-frame • Mansard • Shed • Dormer • Flat • Vaulted • Saw-toothed • Domed • Serpentine • Barrel • Conical |
| 2. Describe roof construction features | <ul style="list-style-type: none"> • Trusses and rafters • Beams • Ridges • Valleys • Eaves • Edges • Decking • Insulation |
| 3. Describe roof slopes | <ul style="list-style-type: none"> • Ratio/pitch • Rise • Run |
| 4. Perform basic roof calculations | <ul style="list-style-type: none"> • Pythagoras • Ratio and proportion |



3. Communicate with others

- Supervisors
- Other workers
- Apprentices
- Architects
- Engineers
- Inspectors
- Safety officers
- Other trades
- Customers
- Building occupants
- General public



- 3. Position equipment and material on the ground
 - Equipment
 - Kettles
 - Propane tanks
 - Disposal Bins
 - Placement
 - Regulations
 - Safety equipment
 - Hoses
 - Fire extinguishers
 - Safety cones
 - Caution tape
 - Safety fence
 - Communication with owner, contractor and other trades people

- 4. Position equipment and material on the roof
 - Equipment
 - Hoist
 - Roof cutter
 - mini mop
 - Sequence of removal and installation
 - Weight distribution
 - Safety
 - Securement
 - Propane tank storage
 - Windows
 - Ventilation openings
 - Ease of access
 - Safety equipment
 - Water hoses
 - Fire extinguishers
 - Communication with owner, contractor and other trades people

- 5. Protect windows, walls, skylights and mechanical equipment
 - Protection materials
 - Tarps
 - Plywood
 - Blankets
 - Fabric
 - Type of damage
 - Broken glass
 - Fume infiltration
 - Staining
 - Fire
 - Identification of areas of potential damage
 - Windows

**Program Content
Level 1**



- Walls
- Skylights
- Mechanical equipment
- Vehicles
- Identification of areas of previous damage
- Barrier erection
- Placement of materials



Line (GAC): **D Organize Work**
Competency: **D4 Estimate Quantities of Materials**

Objectives

To be competent in this area the individual must be able to:

- Perform mathematical calculations using whole numbers, fractions, decimals and ratios.
- Convert between metric and imperial units of measure.
- Solve problems involving area and volume.

LEARNING TASKS

CONTENT

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Add, subtract, multiply and divide whole numbers
 2. Solve problems with fractions, ratios and decimals

 3. Convert to and from metric and imperial measurements | <ul style="list-style-type: none"> • Operations • Practical word problems
 • Operations <ul style="list-style-type: none"> ○ Fractions <ul style="list-style-type: none"> – Lowest terms ○ Ratios ○ Decimals • Decimal to fraction conversions • Fraction to decimal conversions • Convert measurements to ratios • Practical word problems
 • Metric to imperial • Imperial to metric • Weights • Lengths • Volumes • Temperature • Prefixes • Practical word problems |
|---|--|



4. Solve plane geometry problems
 - Perimeters of shapes
 - Squares
 - Rectangles
 - Triangles
 - Pentagons and higher order polygons
 - Circles
 - Areas of shapes
 - Squares
 - Rectangles
 - Triangles
 - Pentagons and higher order polygons
 - Circles
 - Volumes of shapes
 - Polyhedrons
 - Cylinders
 - Practical word problems



3. Describe the removal of roofing and metal flashings
 - System types
 - Components
 - Effect of weather conditions
 - Removal sequence
 - Hazards
 - Rotten deck
 - Nails
 - Electric wiring
 - Recyclable materials
 - Regulated and hazardous materials
 - Removal equipment selection
 - Removal techniques
 - Amount of roof exposure in a given work time
 - Temporary sealing
 - Temporary drainage
 - Removal and disposal of materials

4. Describe the preparation of the roof substrate
 - Types of deck substrates
 - Concrete
 - Steel
 - Wood
 - Substrate defects
 - Dents
 - Rotten wood
 - Spalling concrete
 - Corrosion
 - Cleaning substrate
 - Vapour barriers
 - Repair
 - Replacement
 - Insulation
 - Repair
 - Replacement
 - Structural defects
 - Securing loose substrate components



5. Describe the adjustment of heights of penetrations and parapets
 - New roof composition
 - Changes to roof mounted equipment
 - Adjustments
 - Adding slope to coping
 - Extending
 - Pipes
 - Drains
 - Doorsills
 - Height calculations
 - Penetrations
 - Parapets
 - Building extensions
 - Material selection to suit new construction
 - Dismantling existing construction
 - Adding material to existing construction

6. Describe the installation of water cut-offs, temporary seals and temporary drains
 - Water cut-offs
 - Temporary
 - Permanent
 - Requirements for
 - Water cut-offs
 - Temporary seals
 - Temporary drains
 - Materials
 - Asphalt
 - Sealant
 - Membrane
 - Material compatibility
 - Determining integrity
 - Removal

7. Prepare the roof for replacement
 - Removal of debris
 - Protection of windows, walls, skylights and mechanical equipment
 - Removal of roofing and flashing
 - Preparation of roof substrate
 - Adjustment of heights of penetrations and parapets
 - Installation of water cut-offs, temporary seals and temporary drains



Line (GAC): **E Prepare Roofs**
Competency: **E2 Prepare Roofs for New Installation**

Objectives

To be competent in this area the individual must be able to:

- Prepare a roof for a new installation.

LEARNING TASKS

1. Describe how to clean the deck

2. Describe how to inspect the deck

CONTENT

- Deck types
 - Steel
 - Wood
 - Concrete
- Timing of cleaning
- Size of area to be cleaned for time limitations
- Extent of cleaning required
- Hazards
 - Rust from phenolic insulation
- Tools
 - Brooms
 - Power brooms
 - Vacuums
 - Air compressors
- Contaminant removal
 - Oil
 - Fuel
 - Concrete
- Limiting access after cleaning
- Deck types
 - Steel
 - Wood
 - Concrete
- Inspection requirements
- When to inspect
- Defects
 - Height
 - Irregularities
 - Deck deflection
 - Uncured concrete
 - Corrosion
 - Locating
 - Severity
 - Notification of responsible parties



3. Describe how to verify the placement of roof penetrations and parapets
 - Required penetrations and parapets
 - Height and fastening requirements
 - Locations
 - Required components
 - Drains
 - Flashings
 - Chimney flashings
 - Clearances and placement
 - Deck types
 - Verification of securing
 - Cants
 - Blocking
 - Reglets
 - Nailers
 - Compatibility of components with roofing system

4. Describe how to dry the deck
 - Techniques
 - Vacuuming
 - Dry mopping
 - Torching
 - Hazards of drying techniques
 - Types of deck
 - Effect of weather conditions on drying time
 - How much to dry at one time
 - When deck is dry enough
 - Limiting deck exposure to moisture

5. Prepare the roof for new installation
 - Cleaning
 - Inspection
 - Verification of placement of roof penetrations and parapets
 - Drying



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F1 Install Gypsum Board and Insulation

Objectives

To be competent in this area the individual must be able to:

- Describe the purpose of insulation and fasteners.
- Describe insulation and fasteners.
- Install insulation using fasteners and/or adhesives.

LEARNING TASKS

1. Describe thermal insulation and fasteners

CONTENT

- Heat transfer terms
 - Conduction
 - Convection
 - Radiation
 - R and K factors
- Types
 - Fibre board
 - Polystyrene (expanded and extruded)
 - Polyurethane
 - Fibreglass
 - Polyisocyanurate
- Purpose
- Fasteners
 - Purpose
 - Adhesives
 - Mechanical fasteners
 - Pattern
- Tools
 - Adhesive
 - Mechanical fasteners
 - Selection
 - Decking
 - Roofing material
 - Fastener
- Storage
 - Protection from the elements (weather)
- Selection of insulation and fastening methods
 - Roof slope
 - Decking
 - Roofing material
 - Specifications
- Roof insulation guarantee systems



- RCABC Guarantee Standards
 - Manufacturers' Guarantee Standards
 - Effect of weather on installation

- 2. Install insulation on metal decks
 - Types of insulation
 - Gypsum board
 - Purpose
 - Cutting, fitting and placement of insulation
 - Cutting, fitting and placement of gypsum board
 - Deck loading
 - Adhesives
 - Types
 - Application
 - Types of fasteners
 - Number of fasteners
 - Location of fasteners
 - Joint sealing
 - Protected membrane roof systems

- 3. Install insulation on wood decks
 - Liquid applications (mop and sprinkle)
 - Types of insulation
 - Cutting, fitting and placement of insulation
 - Deck loading
 - Types of fasteners
 - Number of fasteners
 - Location of fasteners
 - Joint sealing
 - Protected membrane roof systems

- 4. Install insulation on concrete decks
 - Self-adhesive
 - Multi-layered
 - Types of insulation
 - Cutting, fitting and placement of insulation
 - Deck loading
 - Types of fasteners
 - Number of fasteners
 - Location of fasteners
 - Joint sealing
 - Protected membrane roof systems



5. Install insulation on composite decks
 - Types of insulation
 - Cutting, fitting and placement of insulation
 - Deck loading
 - Types of fasteners
 - Number of fasteners
 - Location of fasteners
 - Joint sealing
 - Protected membrane roof systems



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F2 Install Overlay Board

Objectives

To be competent in this area the individual must be able to:

- Describe overlay board and its purpose.
- Install overlay board.

LEARNING TASKS

1. Describe overlay board

2. Install overlay board

CONTENT

- Types
 - Wood fibre
 - Fibreglass
 - SBS boards
 - Asphalt-impregnated
- Purpose
- Selection
 - Compatibility with other materials
- RCABC, architectural and manufacturers' specifications
- Cutting, fitting and placing
- Fasteners
- Adhesives
- Joint sealing
- Effect of weather on installation



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F3 Install Vapour Retarders and Air Barriers

Objectives

To be competent in this area the individual must be able to:

- Describe vapour retarders and their purpose.
- Install vapour retarders.

LEARNING TASKS

1. Describe vapour retarders and air barriers

2. Install vapour retarders

CONTENT

- Purpose
 - Vapour retarder
 - Moisture prevention
 - Air barrier
 - Air flow prevention
- Types
 - Self adhesive
 - Liquid
 - Felts
 - Modified bituminous bitumens
 - Kraft laminate
 - Two-ply felts
- Selection
 - Code requirements
 - Guarantee requirements
 - Specifications
- Types
- Manufacturers' specifications
- Adhesive application methods
- Compatibility with vapour retarders and air barriers
- Details
- Cutting
- Fitting
- Placing
- Overlap, seam and seal joints
- Tying vapour retarder and air barrier in building envelope
- Continuity of vapour retarders and air barriers at penetrations and intersecting walls
- Effect of weather on installation



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F4 Install Flashing Materials

Objectives

To be competent in this area the individual must be able to:

- Describe flashing materials and their purpose.

LEARNING TASKS

1. Describe flashings

2. Describe gutters, drains and vents

CONTENT

- Purpose
- Code requirement
- Guarantee requirements
- Materials
 - Metals
 - Aluminum
 - Copper
 - Stainless steel
 - Galvanized steel
 - Plastics
 - Other
- Fasteners
 - Compatibility with flashing
- Watershed design principles
- Expansion and contraction
- Caulking
- Cutting, finishing, fastening and flashing
- Purpose
- Code requirements
- Guarantee requirements
- Materials
 - Metals
 - Plastics
 - Adhesives and sealants
 - Modified bituminous membranes
 - Cold applied
 - Hot applied



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F5 Install Built-up Roofing Systems

Objectives

To be competent in this area the individual must be able to:

- Describe hot built-up roofing systems and materials.
- Install hot built-up roofing systems.

LEARNING TASKS

1. Describe hot built-up roofing (BUR) materials

2. Describe protected and modified membrane roofs (PMR) (MPMR)

3. Install hot built-up roofing systems

CONTENT

- Properties
 - Felts (organic, glass fibre, polyester)
 - Bitumen (types 1, 2, 3, 4)
 - Surfacing materials
 - Protection materials
 - Aggregates/ballast
 - Types
 - Sealants
 - Walkways
- Selection
 - RCABC accepted materials
 - RCABC, architectural and manufacturers' specifications
 - Surfacing materials
 - Aggregates/ballast
 - Sealants
 - Coatings
- Properties
 - Membranes
 - Insulation types
 - Ballast
- Selection
 - RCABC and manufacturer's specifications
 - Membranes
 - Surfacing materials
 - Aggregates/ballast
 - Sealants
- Drains
 - Determine slope (structure, tapered, insulation)
 - Flanges
 - Flashings



- Sealants
 - Roof details
 - Types
 - Application methods
 - Location
 - Wood blocking and cant strips
 - Cut
 - Install
 - Priming concrete decks
 - Environmental considerations
 - Manufacturers' specifications
 - Application methods
 - Roofing felts
 - Organic
 - Glass
 - Polyester
 - RCABC, architectural and manufacturers' specifications
 - Fibreglass mops
 - Corners
 - Inside
 - Outside
 - Cutting
 - Sealing
 - Joints
 - Control joints
 - Expansion joints
 - Ballast
 - Manual application
 - Machine application
 - Other methods
 - Walkways
 - Effect of weather on installation
 - Manufacturers
4. Install proprietary systems



Line (GAC): G Install Steep Roofing

Competency: G1 Install Asphalt Shingles

Objectives

To be competent in this area the individual must be able to:

- Describe asphalt shingles and their purpose.
- Install asphalt shingles.

LEARNING TASKS

1. Describe components and considerations

2. Inspect and repair deck

3. Install insulation

CONTENT

- Decks
 - Wood
 - Steel
 - Slope
- Eave protection
- Underlayment
- Insulation
- Ventilation
 - Types
 - Application
- Shingles
 - Styles
 - Composition
 - Purpose
- Fasteners
- Details
- Metal flashing
- Effect of weather on installation
- Building Code requirements
- RCABC, architectural and manufacturers' specifications
- Fastening
- Clean
- Defects
- Details
- Requirements
 - Cathedral
 - Insulated roof assemblies



- 4. Install eave protection and underlayments
 - Types
 - Felt
 - Self-adhered
 - Mineral surfaced
 - Purpose
 - Building Code requirements
 - RCABC, architectural and manufacturers' specifications
 - Materials
 - Fastening methods
 - Overlaps

- 5. Install flashing details
 - Types
 - Drip edge
 - Rake edge
 - Step
 - Base
 - Counter
 - Through-wall
 - Back pan
 - Apron
 - Saddles or crickets
 - Valley
 - Materials
 - Metal
 - Neoprene
 - Plastic
 - Selection
 - Forming
 - Fasteners
 - Types
 - Location
 - Methods
 - Caulking and sealants



6. Install shingles

- Building Code requirements
- RCABC, architectural and manufacturers' specifications
- Styles
- Applications
- Details
 - Valleys
- Starting point
- Layout
 - Chalk line
 - Starter course
 - Exposure and overlap
 - Patterns
 - Alignment
- Fasteners
 - Type
 - Length
 - Number
 - Location
- Cap shingles
 - Hips
 - Ridges
- Wind considerations
 - Adhesives/sealants
 - Nailing patterns

Achievement Criteria:

Performance The individual will install an asphalt shingle roof.

- Conditions The individual will be given:
- Roof deck
 - Materials
 - Tools
 - Specifications
 - Personal protective equipment

- Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Safety
 - Application
 - Removal



Level 2

Rofer, Damp and Waterproofer



Line (GAC): A Use Safe Work Practices

Competency: A1 Describe Workplace Hazards

Objectives

To be competent in this area the individual must be able to:

- Describe workplace hazards.
- To locate and use emergency equipment.

LEARNING TASKS

1. Review hazards in the roofing industry

2. Review long term hazards

3. Review safety precautions in high rise buildings

CONTENT

- Falls
- Ladders
- Debris
- Fire
- Electrical
- Lockout procedures
- Compressed gas
- Fuels (liquid and gaseous)
- Hot Asphalt
- Alcohol
- Drugs
- Lifting
- Personal apparel
 - Clothing
 - Hair and beards
 - Jewellery
- Housekeeping
- Horseplay
- Respect for others safety
- Constant awareness of surroundings
- Working below grade

- Respiratory disease
- Skin disease
- Asbestos

- Company safety policies
- Training and certification requirements
- Hazard identification
- Wind
- Floor openings
- Guard rails
- Safety lines
- Weather



4. Review emergency equipment and means of egress
 - Emergency shutoffs
 - Fire control systems
 - Emergency exits
 - First aid facilities
 - Emergency contacts/phone numbers
 - Muster station



Line (GAC): **A Use Safe Work Practices**
Competency: **A5 Use Fire Safety Procedures**

Objectives

To be competent in this area the individual must be able to:

- Obtain certification for the National Torch Safety Program.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| <ol style="list-style-type: none">1. Obtain certification for the National Torch Safety Program | <ul style="list-style-type: none">• Program content• Six modules |
|---|---|



Line (GAC): **C Use Documentation**
Competency: **C2 Use Building Codes and RCABC Standards**

Objectives

To be competent in this area the individual must be able to:

- Locate and interpret sections of the provincial and national building codes that apply to the roofing trade.
- Describe guarantee program recommendations that exceed the requirements of other codes.
- Describe municipal requirements that supersede or amend the provincial building codes.

LEARNING TASKS

CONTENT

- | | |
|--|---|
| 1. Interpret the BC and National Building Codes | <ul style="list-style-type: none"> • Sections • Materials • Flashing • Eaves • Bearing walls • Trusses and rafters • Decking • Insulation and weatherproofing • Installation • Loads • Differences between the codes |
| 2. Identify municipal code requirements for roofing | <ul style="list-style-type: none"> • Loads (esp. snow) • Materials • Permits • Inspections |
| 3. Describe guarantee programs which exceed the BC and National Building Codes | <ul style="list-style-type: none"> • CSA/ISO • RCABC (RGC) • Manufacturers |



Line (GAC): **C Use Documentation**
Competency: **C3 Read Manufacturers' Information**

Objectives

To be competent in this area the individual must be able to:

- Interpret manufacturers' instructions and specifications.

LEARNING TASKS

3. Interpret roofing system manufacturers' specifications

4. Use roofing system manufacturers' application procedures

CONTENT

- Manufacturers' specifications
- Manufacturers' installation instructions
- Manufacturers' inspection and maintenance information
- Manufacturers' troubleshooting documentation

- Installation
- Fastening methods
- Handling
- Storage
- Overlaps
- Minimums/maximums



Line (GAC): **D Organize Work**
Competency: **D4 Estimate Quantities of Materials**

Objectives

To be competent in this area the individual must be able to:

- Perform mathematical calculations using whole numbers, fractions, decimals and ratios.
- Convert between metric and imperial units of measure.
- Solve problems involving area and volume.
- Use mathematics to estimate material quantities.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Review operations with whole numbers
 2. Review operations with fractions, ratios and decimals
 3. Review conversion between metric and imperial units of measure
 4. Review solving plane geometry problems | <ul style="list-style-type: none"> • Operations • Practical word problems
 • Operations <ul style="list-style-type: none"> ○ Fractions <ul style="list-style-type: none"> – Lowest terms ○ Ratios ○ Decimals • Decimal to fraction conversions • Fraction to decimal conversions • Convert measurements to ratios • Practical word problems
 • Metric to imperial • Imperial to metric • Weights • Lengths • Volumes • Temperature • Prefixes • Practical word problems
 • Perimeters of shapes <ul style="list-style-type: none"> ○ Squares ○ Rectangles ○ Triangles ○ Pentagons and higher order polygons ○ Circles • Areas of shapes <ul style="list-style-type: none"> ○ Squares ○ Rectangles ○ Triangles |
|---|---|



- Pentagons and higher order polygons
 - Circles
 - Volumes of shapes
 - Polyhedrons
 - Cylinders
 - Practical word problems
5. Calculate an estimate of materials required for a flat roof system
- Asphalt
 - Gravel
 - Felt
 - Wastage
 - Insulation
 - Modified bituminous membranes
6. Calculate an estimate of materials required for a steep roof
- Underlay
 - Shingles
 - Wastage
 - Eave protection
 - Valley material
 - Fasteners

Achievement Criteria

- Performance The individual will calculate material requirements for a flat roof system.
- Conditions The individual will be given:
- A plan
 - Specifications
 - Calculator
- Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Correct answer
 - Calculation method

Achievement Criteria

- Performance The individual will calculate material requirements for a steep roof.
- Conditions The individual will be given:
- A plan
 - Specifications
 - Calculator
- Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Correct answer
 - Calculation method



- | | |
|--|---|
| <p>4. Review the installation of insulation on concrete decks</p> | <ul style="list-style-type: none"> • Self-adhesive • Multi-layered • Types of insulation • Cutting, fitting and placement of insulation • Deck loading • Types of fasteners • Number of fasteners • Location of fasteners • Joint sealing • Protected membrane roof systems |
| <p>5. Review the installation of insulation on composite decks</p> | <ul style="list-style-type: none"> • Types of insulation • Cutting, fitting and placement of insulation • Deck loading • Types of fasteners • Number of fasteners • Location of fasteners • Joint sealing • Protected membrane roof systems |



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F2 Install overlay board

Objectives

To be competent in this area the individual must be able to:

- Describe overlay board and its purpose.
- Install overlay board.

LEARNING TASKS

1. Review overlay board

2. Review the installation of overlay board

CONTENT

- Types
- Purpose
- Selection
- RCABC, architectural and manufacturers' specifications

- Purpose
- Manufacturers' requirements
- Guarantee requirements
- Materials
 - Metals
 - Adhesives and sealants
 - Modified bituminous membranes
 - Cold applied
 - Hot applied
- Effect of weather in installation



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F6 Install Flexible Membrane Roof Systems

Objectives

To be competent in this area the individual must be able to:

- Describe flexible membrane roofing systems.
- Install flexible membrane roofing systems.

While the content of the F-6 competencies in levels two and three may appear to be the same, they focus on different manufacturers' systems and specifications. Installation methods differ for different manufacturers' products and roof life depends on proper installation.

LEARNING TASKS

CONTENT

1. Describe flexible membrane roof system

- Types
 - SBS (Styrene-Butadiene-Styrene)
 - APP (Atactic Polypropylene)
 - EPDM (Ethylene Propylene Diene Monomer)
 - PVC (Polyvinylchloride)
 - TPO (Thermoplastic Polyolefin)
- RCABC, architectural and manufacturers' specifications
- Properties
- Selection
- Limitations
- Applications

2. Install flexible membrane roof systems

- Types
- RCABC, architectural and manufacturers' specifications
- Applying membranes
 - Deck preparation
 - Relax membranes
 - Set membranes
 - Methods
 - Hot process
 - Torch-applied
 - Hot-air welded
 - Adhesives
 - Self-adhered
 - Mechanically fastened
 - Loose-laid
- Details
 - Drains



- Roof details
- Wood blocking and cant strips
- Corners
- Joints
- Ballast
- Walkways
- Effect of weather in installation

Achievement Criteria:

Performance The individual will install SBS on a flat roof.

Conditions The individual will be given:

- A flat roof
- Materials
- Tools and equipment
- Specifications

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:

- Safety
- Application procedure
- Personal protective equipment

Performance The individual will install EPDM on a flat roof.

Conditions The individual will be given:

- A flat roof
- Materials
- Tools and equipment
- Specifications

Criteria

- Safety
- Application procedure
- Personal protective equipment

Performance The individual will install TPO on a flat roof.

Conditions The individual will be given:

- A flat roof
- Materials
- Tools and equipment
- Specifications

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:

- Safety
- Application procedure
- Personal protective equipment



- 4. Install eave protection and underlayments
 - Types
 - Felt
 - Self-adhered
 - Purpose
 - Building Code requirements
 - RCABC, architectural and manufacturers' specifications
 - Materials
 - Fastening methods
 - Overlaps

- 5. Install flashing details
 - Types
 - Step
 - Base
 - Counter
 - Through-wall
 - Back pan
 - Apron
 - Saddles or crickets
 - Valley
 - Materials
 - Metal
 - Neoprene
 - Plastic
 - Selection
 - Forming
 - Fasteners
 - Types
 - Location
 - Methods
 - Caulking and sealants

- 6. Install shingles
 - Building Code requirements
 - RCABC, architectural and manufacturers' specifications
 - Grades
 - Applications
 - Details
 - Starting point
 - Layout
 - Chalk line
 - Starter course
 - Exposure and overlap
 - Patterns



- Alignment
- Fasteners
 - Type
 - Length
 - Number
 - Location
- Cap shingles
 - Hips
 - Ridges
- Environmental considerations

Achievement Criteria:

Performance The individual will install a wood shingle roof.

Conditions The individual will be given:

- Roof deck
- Materials
- Tools
- Specifications
- Personal protective equipment

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:

- Safety
- Application
- Removal

Performance The individual will install a wood shake roof.

Conditions The individual will be given:

- Roof deck
- Materials
- Tools
- Specifications
- Personal protective equipment

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:

- Safety
- Application
- Removal



- 4. Install eave protection and underlayments
 - Types
 - Felt
 - Self-adhered
 - Purpose
 - Building Code requirements
 - RCABC, architectural and manufacturers' specifications
 - Materials
 - Fastening methods
 - Overlaps

- 5. Install flashing details
 - Types
 - Channel
 - Base
 - Counter
 - Through-wall
 - Back pan
 - Apron
 - Saddles or crickets
 - Valley
 - Materials
 - Metal
 - Lead
 - Neoprene
 - Plastic
 - Selection
 - Forming
 - Fasteners
 - Types
 - Location
 - Methods
 - Caulking and sealants



6. Install tiles

- Building Code requirements
- RCABC, architectural and manufacturers' specifications
- Styles
- Applications
- Details
- Starting point
- Layout
 - Chalk line
 - Starter course
 - Exposure and overlap
 - Patterns
 - Alignment
- Fasteners
 - Type
 - Length
 - Number
 - Location
- Cap tiles
 - Hips
 - Ridges
 - Mortaring
- Environmental considerations



Line (GAC): G Install Steep Roofing

Competency: G4 Install Metallic Materials

Objectives

To be competent in this area the individual must be able to:

- Describe preformed metal tiles and their application.
- Install preformed metal tiles.

LEARNING TASKS

1. Describe components and considerations

2. Inspect and repair deck

3. Install insulation

CONTENT

- Decks
 - Wood
 - Steel
 - Slope
- Eave protection
- Underlayment
- Insulation
- Ventilation
 - Types
 - Application
- Preformed metal tiles
 - Styles
 - Purpose
- Battens
- Fasteners
- Details
- Metal flashing
- Equipment
- Tools
- Effect of weather in installation
- Building Code requirements
- RCABC, architectural and manufacturers' specifications
- Fastening
- Clean
- Defects
- Details
- Requirements
 - Insulated roof assemblies



- 4. Install eave protection and underlayments
 - Types
 - Felt
 - Self-adhered
 - Purpose
 - Building Code requirements
 - RCABC, architectural and manufacturers' specifications
 - Materials
 - Fastening methods
 - Overlaps

- 5. Install flashing details
 - Types
 - Closures
 - Base
 - Counter
 - Through-wall
 - Back pan
 - Apron
 - Saddles or crickets
 - Valley
 - Materials
 - Metal
 - Lead
 - Neoprene
 - Plastic
 - Selection
 - Forming
 - Fasteners
 - Types
 - Location
 - Methods
 - Caulking and sealants



6. Install preformed metal tiles

- Building Code requirements
- RCABC, architectural and manufacturers' specifications
- Styles
- Applications
- Details
- Starting point
- Layout
 - Chalk line
 - Starter course
 - Exposure and overlap
 - Patterns
 - Alignment
 - Calculating angles
- Fasteners
 - Type
 - Length
 - Number
 - Location
- Metal cap
 - Hips
 - Ridges
- Environmental considerations



Line (GAC): **I** **Apply Waterproofing and Damp-Proofing**
Competency: **I1** **Waterproof Surfaces**

Objectives

To be competent in this area the individual must be able to:

- Describe waterproofing and its applications.
- Install waterproofing

LEARNING TASKS

1. Describe waterproofing

CONTENT

- Purpose
- Uses
 - Floors above and below grade
 - Beneath roofs and plaza decks
 - Kitchens
 - Showers
 - Mechanical equipment rooms
 - Bridge decks
 - Pools, planters, lagoons, irrigation trenches
- Systems
- Hydrostatic head pressures
- Terminology
- Methods of applications
- Materials
- Equipment
- Selection
- Substrate preparation
- Above grade applications
- Below grade applications
- Protection course
- Confined spaces
- Drainage
- UV resistance
- Details
- Traffic surfaces
- Effect of weather in installation



2. Install or apply waterproofing

- Safety
- Materials
- Handling and storage
- Equipment
- Substrate preparation
- Methods of application
- Details
- Protection course
- Back filling
- Code requirements
- Manufacturers' specifications
- Environmental considerations



Line (GAC): I Apply Waterproofing and Damp-Proofing

Competency: I2 Damp-Proof Surfaces

Objectives

To be competent in this area the individual must be able to:

- Describe damp-proofing and its applications.
- Install damp-proofing.

LEARNING TASKS

1. Describe damp-proofing

CONTENT

- Purpose
- Uses
 - Usually above grade
 - Below grade in the absence of hydrostatic head pressure
- Systems
- Hydrostatic head pressures
- Terminology
- Methods of applications
- Materials
- Equipment
- Selection
- Substrate preparation
- Above grade applications
- Below grade applications
- Protection course
- Confined spaces
- Drainage
- UV resistance
- Details
- Effect of weather in installation

2. Install or apply damp-proofing

- Safety
- Materials
- Handling and storage
- Equipment
- Substrate preparation
- Methods of application
- Details
- Protection course
- Back filling
- Code requirements
- Manufacturers' specifications
- Environmental considerations



Level 3

Roofer, Damp and Waterproofer



Line (GAC): A Use Safe Work Practices

Competency: A1 Describe Workplace Hazards

Objectives

To be competent in this area the individual must be able to:

- Describe workplace hazards.
- To locate and use emergency equipment.

LEARNING TASKS

CONTENT

1. Review hazards in the roofing industry

- Falls
- Ladders
- Debris
- Fire
- Electrical
- Lockout procedures
- Compressed gas
- Fuels (liquid and gaseous)
- Hot Asphalt
- Alcohol
- Drugs
- Lifting
- Personal apparel
 - Clothing
 - Hair and beards
 - Jewellery
- Housekeeping
- Horseplay
- Respect for others safety
- Constant awareness of surroundings
- Working below grade

2. Review long term hazards

- Respiratory disease
- Skin disease
- Asbestos

3. Review safety precautions in high rise buildings

- Company safety policies
- Training and certification requirements
- Hazard identification
- Wind
- Floor openings
- Guard rails
- Safety lines
- Weather



4. Locate emergency equipment and means of egress
 - Emergency shutoffs
 - Fire control systems
 - Emergency exits
 - First aid facilities
 - Emergency contacts/phone numbers
 - Muster station



Line (GAC): A Use Safe Work Practices
Competency: A4 Use Personal Protective Equipment

Objectives

To be competent in this area the individual must be able to:

- Select and use personal protective equipment.
- Inspect, maintain and store personal protective equipment.

LEARNING TASKS

CONTENT

- | | |
|--|--|
| <p>1. Review personal safety equipment</p> | <ul style="list-style-type: none"> • Fall Protection • Gloves • Safety footwear • Eye protection • Ear protection • Head protection • Respiratory protection • Clothing |
| <p>2. Review fall restraint and arrest systems and equipment</p> | <ul style="list-style-type: none"> • Lifelines • Safety nets • Crawl boards • Slide guards • Ladder-jack scaffolds • Harnesses • Installation |
| <p>3. Use personal safety equipment</p> | <ul style="list-style-type: none"> • Regulations and legislation • Certification requirements • Selection of equipment • Operating procedures • Safety procedures during installation • Inspection • Maintenance • Storage |



Line (GAC): **C Use Documentation**
Competency: **C1 Read Drawings and Specifications**

Objectives

To be competent in this area the individual must be able to:

- Read and interpret drawings and specifications

LEARNING TASKS

CONTENT

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Review major elements of blueprints
 2. Review types of roofing specifications and codes
 3. Estimate areas and perimeters | <ul style="list-style-type: none"> • Architectural drawings • Structural drawings • Mechanical drawings • Electrical drawings • Architectural specifications
 • Architectural specifications • Manufacturer’s specifications • Regional specifications (e.g. RCABC) • National Building Code • BC Building Code
 • Drawings • Formulas • Tools • Calculator |
|---|---|

Achievement Criteria:

Performance The individual will calculate areas and perimeters.

- Conditions** The individual will be given:
- Drawings
 - Scales
 - Calculator
 - Formulas

- Criteria** The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Correct answer
 - Work shown
 - Methods



Line (GAC): **C Use Documentation**
Competency: **C2 Use Building Codes and RCABC Standards**

Objectives

To be competent in this area the individual must be able to:

- Locate and interpret sections of the provincial and national building codes that apply to the roofing trade.
- Describe guarantee program recommendations that exceed the requirements of other codes.
- Describe municipal requirements that supersede or amend the provincial building codes.

LEARNING TASKS

CONTENT

- | | |
|--|---|
| 1. Interpret the BC and National Building Codes | <ul style="list-style-type: none"> • Sections • Materials • Flashing • Eaves • Bearing walls • Trusses and rafters • Decking • Insulation and weatherproofing • Installation • Loads • Differences between the codes |
| 2. Identify municipal code requirements for roofing | <ul style="list-style-type: none"> • Loads (esp. snow) • Materials • Permits • Inspections |
| 3. Describe guarantee programs which exceed the BC and National Building Codes | <ul style="list-style-type: none"> • CSA/ISO • RCABC (RGC) • Manufacturers |



Line (GAC): **C Use Documentation**
Competency: **C3 Read Manufacturers' Information**

Objectives

To be competent in this area the individual must be able to:

- Interpret manufacturers' instructions and specifications.

LEARNING TASKS

1. Interpret roofing system manufacturers' specifications

2. Use roofing system manufacturers' application procedures

CONTENT

- Manufacturers' specifications
- Manufacturers' installation instructions
- Manufacturers' inspection and maintenance information
- Manufacturers' troubleshooting documentation

- Installation
- Fastening methods
- Handling
- Storage
- Overlaps
- Minimums/maximums



Line (GAC): **D Organize Work**
Competency: **D4 Estimate Quantities of Materials**

Objectives

To be competent in this area the individual must be able to:

- Perform mathematical calculations using whole numbers, fractions, decimals and ratios.
- Convert between metric and imperial units of measure.
- Solve problems involving area and volume.
- Use mathematics to estimate material quantities.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Review operations with whole numbers
 2. Review operations with fractions, ratios and decimals
 3. Review conversion between metric and imperial units of measure
 4. Review solving plane geometry problems | <ul style="list-style-type: none"> • Operations • Practical word problems
 • Operations <ul style="list-style-type: none"> ○ Fractions <ul style="list-style-type: none"> – Lowest terms ○ Ratios ○ Decimals • Decimal to fraction conversions • Fraction to decimal conversions • Convert measurements to ratios • Practical word problems
 • Metric to imperial • Imperial to metric • Weights • Lengths • Volumes • Temperature • Prefixes • Practical word problems
 • Perimeters of shapes <ul style="list-style-type: none"> ○ Squares ○ Rectangles ○ Triangles ○ Pentagons and higher order polygons ○ Circles • Areas of shapes <ul style="list-style-type: none"> ○ Squares ○ Rectangles ○ Triangles |
|---|---|



- Pentagons and higher order polygons
 - Circles
 - Volumes of shapes
 - Polyhedrons
 - Cylinders
 - Practical word problems

- 5. Calculate an estimate of materials required for a flat roof system
 - Asphalt
 - Gravel
 - Felt
 - Wastage
 - Insulation
 - Modified bituminous membranes

- 6. Calculate an estimate of materials required for a steep roof
 - Underlay
 - Shingles
 - Wastage
 - Eave protection
 - Valley material
 - Fasteners

Achievement Criteria

- | | |
|-------------|--|
| Performance | The individual will calculate material requirements for a flat roof system. |
| Conditions | The individual will be given: <ul style="list-style-type: none"> ● A plan ● Specifications ● Calculator |
| Criteria | The individual will score 70% or better on a rating sheet that reflects the following criteria: <ul style="list-style-type: none"> ● Correct answer ● Calculation method |



Achievement Criteria

Performance The individual will calculate material requirements for a steep roof.

Conditions The individual will be given:

- A plan
- Specifications
- Calculator

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:

- Correct answer
- Calculation method



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F1 Install Gypsum Board and Insulation

To be competent in this area the individual must be able to:

- Describe the purpose of insulation and fasteners.
- Describe insulation and fasteners.
- Install insulation using fasteners and/or adhesives.

LEARNING TASKS

CONTENT

- | | |
|--|---|
| <p>1. Review thermal insulation and fasteners</p> | <ul style="list-style-type: none"> • Heat transfer terms • Types • Purpose • Fasteners • Tools • Storage • Selection of insulation and fastening methods • Roof insulation guarantee systems • Effect of weather on installation |
| <p>2. Review the installation of insulation on metal decks</p> | <ul style="list-style-type: none"> • Types of insulation • Gypsum board • Cutting, fitting and placement of insulation • Cutting, fitting and placement of gypsum board • Deck loading • Adhesives • Fasteners • Joint sealing • Protected membrane roof systems |
| <p>3. Review the installation of insulation on wood decks</p> | <ul style="list-style-type: none"> • Liquid applications (mop and sprinkle) • Types of insulation • Cutting, fitting and placement of insulation • Deck loading • Types of fasteners • Number of fasteners • Location of fasteners • Joint sealing • Protected membrane roof systems |



- | | |
|--|---|
| <p>4. Review the installation of insulation on concrete decks</p> | <ul style="list-style-type: none"> • Self-adhesive • Multi-layered • Types of insulation • Cutting, fitting and placement of insulation • Deck loading • Types of fasteners • Number of fasteners • Location of fasteners • Joint sealing • Protected membrane roof systems |
| <p>5. Review the installation of insulation on composite decks</p> | <ul style="list-style-type: none"> • Types of insulation • Cutting, fitting and placement of insulation • Deck loading • Types of fasteners • Number of fasteners • Location of fasteners • Joint sealing • Protected membrane roof systems |



Line (GAC): **F** **Install Low Slope and Flat Roofing**
Competency: **F3** **Install Vapour Retarders and Air Barriers**

Objectives

To be competent in this area the individual must be able to:

- Describe vapour retarders and their purpose.
- Install vapour retarders.

LEARNING TASKS

1. Review vapour retarders and air barriers

2. Review vapour retarders

CONTENT

- Purpose
 - Vapour retarder
 - Moisture prevention
 - Air barrier
 - Air flow prevention
- Types
 - Self adhesive
 - Liquid
 - Felts
 - Modified bituminous bitumens
 - Kraft laminate
 - Two-ply felts
- Selection
 - Code requirements
 - Guarantee requirements
 - Specifications
- Types
- Manufacturers' specifications
- Adhesive application methods
- Compatibility with vapour retarders and air barriers
- Details
- Cutting
- Fitting
- Placing
- Overlap, seam and seal joints
- Tying vapour retarder and air barrier in building envelope
- Continuity of vapour retarders and air barriers at penetrations and intersecting walls
- Effect of weather on installation



3. Install air barriers

- Types
- Manufacturers' specifications
- Adhesive application methods
- Compatibility with vapour retarders and air barriers
- Details
- Cutting
- Fitting
- Placing
- Overlap, seam and seal joints
- Tying vapour retarder and air barrier in building envelope
- Continuity of vapour retarders and air barriers at penetrations and intersecting walls



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F5 Install Built-up Roofing Systems

Objectives

To be competent in this area the individual must be able to:

- Describe hot built-up roofing systems and materials.
- Install hot built-up roofing systems.

LEARNING TASKS

1. Describe hot built-up roofing (BUR) materials

2. Describe cold built-up materials

CONTENT

- Properties
 - Felts (organic, glass fibre, polyester)
 - Bitumen (types 1, 2, 3, 4)
 - Surfacing materials
 - Protection materials
 - Aggregates/ballast
 - Types
 - Sealants
 - Walkways
- Selection
 - RCABC accepted materials
 - RCABC, architectural and manufacturers' specifications
 - Surfacing materials
 - Aggregates/ballast
 - Sealants
 - Coatings
- Properties
 - Membranes
 - Surfacing materials
 - Protection materials
 - Aggregates/ballast
 - Types
 - Sealants
 - Walkways
- Selection
 - RCABC and manufacturer's specifications
 - Membranes
 - Surfacing materials
 - Aggregates/ballast
- Sealants



3. Review protected and modified membrane roofs (PMR) (MPMR)
 - Properties
 - Membranes
 - Insulation types
 - Ballast
 - Selection
 - RCABC and manufacturer's specifications
 - Membranes
 - Surfacing materials
 - Aggregates/ballast
 - Sealants

4. Review the installation of hot built-up roofing systems
 - Drains
 - Determine slope (structure, tapered, insulation)
 - Flanges
 - Flashings
 - Sealants
 - Roof details
 - Types
 - Application methods
 - Location
 - Wood blocking and cant strips
 - Cut
 - Install
 - Priming concrete decks
 - Environmental considerations
 - Manufacturers' specifications
 - Application methods
 - Roofing felts
 - Organic
 - Glass
 - Polyester
 - RCABC, architectural and manufacturers' specifications
 - Fibreglass mops
 - Corners
 - Inside
 - Outside
 - Cutting
 - Sealing
 - Joints
 - Control joints



- Expansion joints
 - Ballast
 - Manual application
 - Machine application
 - Other methods
 - Walkways
 - Manufacturers
5. Review the installation of proprietary systems



Line (GAC): F Install Low Slope and Flat Roofing

Competency: F6 Install Flexible Membrane Roof Systems

Objectives

To be competent in this area the individual must be able to:

- Describe flexible membrane roofing systems.
- Install flexible membrane roofing systems.

While the content of the F-6 competencies in levels two and three may appear to be the same, they focus on different manufacturers' systems and specifications. Installation methods differ for different manufacturers' products and roof life depends on proper installation.

LEARNING TASKS

CONTENT

3. Describe flexible membrane roof system

- Types
 - SBS (Styrene-Butadiene-Styrene)
 - APP (Atactic Polypropylene)
 - EPDM (Ethylene Propylene Diene Monomer)
 - PVC (Polyvinylchloride)
 - TPO (Thermoplastic Polyolefin)
- RCABC, architectural and manufacturers' specifications
- Properties
- Selection
- Limitations
- Applications

4. Install flexible membrane roof systems

- Types
- RCABC, architectural and manufacturers' specifications
- Applying membranes
 - Deck preparation
 - Relax membranes
 - Set membranes
 - Methods
 - Hot process
 - Torch-applied
 - Hot-air welded
 - Adhesives
 - Self-adhered
 - Mechanically fastened
 - Loose-laid



- Details
 - Drains
 - Roof details
 - Wood blocking and cant strips
 - Corners
 - Joints
 - Ballast
 - Walkways
- Effect of weather in installation

Achievement Criteria:

Performance The individual will install SBS on a flat roof.

- Conditions** The individual will be given:
- A flat roof
 - Materials
 - Tools and equipment
 - Specifications

- Criteria** The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Safety
 - Application procedure
 - Personal protective equipment

Performance The individual will install EPDM on a flat roof.

- Conditions** The individual will be given:
- A flat roof
 - Materials
 - Tools and equipment
 - Specifications

- Criteria** The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Safety
 - Application procedure
 - Personal protective equipment

Performance The individual will install TPO on a flat roof.

- Conditions** The individual will be given:
- A flat roof
 - Materials
 - Tools and equipment
 - Specifications

- Criteria** The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Safety
 - Application procedure
 - Personal protective equipment



Line (GAC): G Install Steep Roofing

Competency: G4 Install Metallic Materials

Objectives

To be competent in this area the individual must be able to:

- Describe preformed metal tiles and their application.
- Install preformed metal tiles.

LEARNING TASKS

1. Describe components and considerations

2. Inspect and repair deck

3. Install insulation

CONTENT

- Decks
 - Wood
 - Steel
 - Slope
- Eave protection
- Underlayment
- Insulation
- Ventilation
 - Types
 - Application
- Preformed metal tiles
 - Styles
 - Purpose
- Battens
- Fasteners
- Details
- Metal flashing
- Equipment
- Tools
- Effect of weather in installation
- Building Code requirements
- RCABC, architectural and manufacturers' specifications
- Fastening
- Clean
- Defects
- Details
- Requirements
 - Insulated roof assemblies



- 4. Install eave protection and underlayments
 - Types
 - Felt
 - Self-adhered
 - Purpose
 - Building Code requirements
 - RCABC, architectural and manufacturers' specifications
 - Materials
 - Fastening methods
 - Overlaps

- 5. Install flashing details
 - Types
 - Closures
 - Base
 - Counter
 - Through-wall
 - Back pan
 - Apron
 - Saddles or crickets
 - Valley
 - Materials
 - Metal
 - Lead
 - Neoprene
 - Plastic
 - Selection
 - Forming
 - Fasteners
 - Types
 - Location
 - Methods
 - Caulking and sealants



6. Install preformed metal tiles

- Building Code requirements
- RCABC, architectural and manufacturers' specifications
- Styles
- Applications
- Details
- Starting point
- Layout
 - Chalk line
 - Starter course
 - Exposure and overlap
 - Patterns
 - Alignment
 - Calculating angles
- Fasteners
 - Type
 - Length
 - Number
 - Location
- Metal cap
 - Hips
 - Ridges
- Environmental considerations



Line (GAC): **H Assess and Maintain Roof, Damp and Waterproofing**
Competency: **H2 Maintain and Repair Roofs, Damp and Waterproofing Objectives**

To be competent in this area the individual must be able to:

- Describe the maintenance and repair of roofs.
- Maintain and repair roofs.

LEARNING TASKS

CONTENT

- | | |
|---|--|
| <p>1. Describe the maintenance and repair of low slope and flat roofs</p> | <ul style="list-style-type: none"> • Inspections • Maintenance • Causes of failures <ul style="list-style-type: none"> ○ Moisture ○ Vegetation ○ Ventilation ○ Drainage ○ Metal fatigue ○ Membrane failure ○ Traffic ○ Aging ○ Wind ○ Impacts ○ Improper design ○ Improper installation ○ UV degradation • Solutions to failure causes |
| <p>2. Describe the maintenance and repair of steep roofs</p> | <ul style="list-style-type: none"> • Inspections • Maintenance • Causes of failure <ul style="list-style-type: none"> ○ Moisture ○ Vegetation ○ Ventilation ○ Underlayment ○ Ice damming ○ Insects ○ Traffic ○ Aging ○ Wind ○ Impacts ○ Improper design ○ Improper installation • Solutions to failure causes |



- 3. Describe repair of damp and waterproofing
 - Causes of failure
 - Structural movement
 - Contamination
 - Mechanical damage
 - Drainage failure
 - Solutions to failure causes

- 4. Maintain and repair low slope and flat roofs
 - Repair methods
 - Blisters
 - Splits
 - Gravel stops
 - Defective flashing
 - Erosion

- 5. Maintain and repair steep roofs
 - Repair methods
 - Valleys
 - Nails backing out of deck
 - Broken shingles
 - Details
 - Defective flashing

- 6. Repair damp and waterproofing
 - Repair methods



Section 4

TRAINING PROVIDER STANDARDS



Facility Requirements

Classroom Area

- Comfortable seating and tables suitable for learning
- Compliance with the local and national fire code and occupational safety requirements
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/Air conditioning for comfort all year round
- In-room temperature control to ensure comfortable room temperature
- Acoustics in the room must allow audibility of the instructor
- Computer lab complete with 16 computers and internet access
- Library complete with reference material for student and instructor use

Shop Area

- 1,100 square foot sheet metal workshop with ceiling height sufficient to allow safe movement of materials
- 13,600 square foot mock-up/storage area which includes:
 - 5,000 square foot steep roofing area
 - 1,300 square foot flat roofing area
 - 120 square foot sheet metal roofing area
 - Tool crib
 - Lockers
- Adequate lighting and lighting control
- Ventilation as per WorkSafeBC standards
- Refuse and recycling bins for used shop materials
- First-aid facilities

Lab Requirements

- N/A

Student Facilities

- Adequate lunch room as per WorkSafeBC requirements
- Adequate washroom facilities as per WorkSafeBC requirements
- Personal Storage lockers

Instructor's Office Space

- Desk and filing space
- Computer

Other

N/A



Tools and Equipment

Shop Equipment Required

Power Tools, Pneumatic Tools, Powder Actuated Tools and Propane Fuelled Equipment

12	Electrical cord	1	Pallet jack
12	Field and detail torches	2	Power saws (circular)
4	Hand drills	1	Pressure washer
6	Hot air gun	11	Propane tank
6	Hot air welder	1	Roll carrier
1	Industrial vacuum	1	Screw gun
2	Kettle burners	2	Strikers

Hand Tools and Equipment

1	Adhesive spreader	2	Pipe wrench
6	Adjustable spanner	1	Pop riveter
1	Aluminum felt broom	6	Pry bar
2	Axe	1	Rake
12	Broom	12	Roof jack
4	Bucket/pail	12	Roofer knife
6	Caulking gun	6	Saw horse
3	Chalk line	16	Scissors
3	Chisels	2	Scoop shovel
2	Drying mop	1	Scraper
6	Flashlight	3	Screwdriver
1	Hacksaw	1	Seam folder
16	Hammer	2	Seam roller
4	Hammer stapler	12	Shovel
1	Hand saw	1	Slater punch
1	Hand spudder	1	Sliding T-bevel
12	Hand roller	1	Squeegee
2	Hatchet	1	Thermometer
12	Hot mop	12	Trowel
1	Infrared heat gun	1	Wheelbarrow
1	Manual gravel spreader	1	Water extractor
6	Measuring tape	4	T-square
1	Mechanical tape applicator	2	Sheet metal brakes (8ft)
1	Metal shear	1	Slitter machine
1	Pan and box brake	4	Soldering irons (propane fuelled)



Hoisting, Lifting and Rigging Equipment

1	Hydraulic Swing hoist	4	Ladders
1	Ladder hoist		

Hot Process Equipment

2	Bitumen kettle	1	Dipper
6	Bitumen mop	1	Mini mop
1	Bitumen pump and piping	8	Mop cart
2	Degranulator		

Motorized Equipment

1	3/4 ton pick-up truck	1	Roof cutter
2	Forklift	1	Rotary spudder
1	Mechanical scraper	1	Snow blower
1	Power broom		

Personal Protective Equipment

2	Ear muffs	6	Lanyard (rope)
1	Eye wash bottle	box	Mask
4	Face shield	6	Portable fire extinguisher
2	First aid kit	32	Safety glasses
80	Guard rail (steep and flat roof) ft.	6	Safety harness

Shop Equipment Recommended

N/A

Shop (Facility) Tools

Standard Tools

N/A

Specialty Tools

N/A



Student Equipment (supplied by school) Required

Sheet Metal Hand Tool Kits

16	Aviation snips set	16	Tinner's hammer
16	Claw hammer	16	Tool box
16	Felt markers	16	Vice grips (Bull nose)
16	Scratch awl	16	Vice grips (Regular)
16	Tape measure		

Recommended

N/A

Student Tools (supplied by student)

Required

N/A

Recommended

N/A



Reference Materials

Required Reference Materials

- Canadian Roofing Reference Manual (Canadian Roofing Contractors Association)
- Occupational Health and Safety Regulation and WCB Standards
- Residential Blueprint Reading Level 1
- Residential Blueprint Reading Level 2
- Soprema Specification Manual (Soprema Inc.)
- Firestone Specifications Manual (Firestone Building Products Canada)
- Carlisle Specification Manual (Carlisle SynTec Systems Canada)
- IKO Specification Manual (IKO Industries Limited)
- Decra Systems Specifications Manual (DECRA Roofing Systems)
- BC and National Building Codes
- National Standards of Canada for Concrete Roof Tile (CSA A220 M91)
- NRCA Roofing and Waterproofing Manual (National Roofing Contractors Association)
- NRCA Repair Manual for Low-slope Membrane Roof Systems (National Roofing Contractors Association)
- WHMIS Publications (WorkSafeBC)
- National Torch Safety Program Booklet (Canadian Roofing Contractors Association)
- The Science and Technology of Traditional and Modern Roofing Systems (Dr. H. O. Laaly)
- Cedar Shake and Shingle Specifications Manual (Cedar Shake and Shingle Bureau)

Recommended Resources

Videos

000 - BUILT-UP ROOFING

VIDEO	PRODUCED BY	SUBJECT	LENGTH
001	NRCA	Kettles, Tankers and Bitumen Heating	42 min.
002	NRCA	Roof Safety: 1. General 2. BUR, Kettle, Tanker 3. Mod. Bit., Single-ply	38 min.
004	NRCA	THE BUILT-UP ROOF MEMBRANE: Provides an overview of the components, design and application considerations of the hot built-up roof. Covers felts, bitumen and roof flashings	20 min.

100 - EQUIPMENT

VIDEO	PRODUCED BY	SUBJECT	LENGTH
103	RIEMAN & GEORGER INC.	Hoisting Equipment Set-up and Operation	35 min.
105	BRIGGS & STRATTON	Preventive Maintenance of Engines	23 min.



200 - INSPECTION AND REPAIR			
VIDEO	PRODUCED BY	SUBJECT	LENGTH
202	NRCA	ROOF PROBLEM ANALYSIS – THE REPAIR OF RE-ROOF DECISION: Covers both investigation of the roof problem and considerations involved in the decision whether to repair or replace the roof. Includes interior and exterior investigation and non-destructive evaluation techniques. Deals with problems of drainage, condition of insulation, membrane condition and attachment, flashings and the various roofing options available.	20 min.
203	NRCA	INSPECTION AND REPAIR: Roof problems	20 min.
300 - INSULATION			
VIDEO	PRODUCED BY	SUBJECT	LENGTH
301	DOW CHEMICAL	Roofmate CT Insulation and roof protection in one material. Application and installation	6 min.
302	FIBREGLASS	PremaSeal Installation Application	7 min. 11 min. 18 min.
303	POSI-SLOPE	Torch Safe Cant and Sloped Fibreglass Insulation	7 min.
304	NRCA	ROOF INSULATION AND ENERGY PAYBACK: Covers the properties of good roof insulation, including application and design considerations and the types of insulation used today. Analyzes the methods used to calculate energy savings for alternative insulation selections and leads the viewer through an actual energy savings calculation case study.	30 min.
400 - MODIFIED BITUMEN			
VIDEO	PRODUCED BY	SUBJECT	LENGTH
401	NRCA	A Guide to Safety Torch-on Modified Bitumens	20 min.
402	U.S. INTEC/BRAI (extract of 4)	Professional Applications of BRI modified bituminous membrane	20 min.
403	NRCA	The MODIFIED BITUMEN MEMBRANE. This program deals w/modified bitumen membrane material, types, specifications and installation procedures. Covers self-adhered, torch-applied and mopped systems	15 min.
404	NRCA	The modified Bitumen Membrane	54 min.
405	SOPREMA	Material Application	25 min.
406	SOPREMA	Installation Techniques	25 min.
408	NRCA	THE MODIFIED BITUMEN MEMBRANE: Examines modified bitumen membrane material, types specifications and installation procedures. Covers self-adhered, torch-applied and mopped systems	20 min.



600 - SAFETY			
VIDEO	PRODUCED BY	SUBJECT	LENGTH
601	WCB	Chemical Hazards in Construction	13 min.
604	GOV'T	WHMIS – Legal Overview	20 min.
606	WCB	WHMIS – What's it all about?	15 min.
609	WCB	WHMIS: Overview	10 min.
		Classification	15 min.
		Labels	15 min.
		MSDS	21 min.
		Education	12 min.
611	PROP. GAS ASSOC. OF CANADA	Working with Propane Dispensing Product	40 min.
613	GARLOCK EQUIPMENT COMPANY	Kettle and Hot Stuff Safety	45 min.
700 - SINGLE PLY (EPDM, PVC)			
VIDEO	PRODUCED BY	SUBJECT	LENGTH
701	U.S. INTEC/BRAI (from Boyds)	Intro. Michael Boyer Professional Application of BRAI Laser Basesheet Torching: Guide to Safety	30 min.
702	SANAFILL I	Application of PVC (Plastomeric)	16 min.
703	CARLISLE	EPDM Products and Installation Description	8 min.
		Seam Preparation using EP-95 Splicing Cement	9 min.
		EPDM flashing with EP-95 Splicing Cement	21 min.
710	NRCA	THE EPDM MEMBRANE: Provides an overview of EPDM membrane material, including installation procedures and flashing details for the loose-laid and ballasted, mechanically attached and fully adhered systems. Includes roof details	20 min.
711	NRCA	THE THERMOPLASTIC ROOF MEMBRANE: Covers PVC and other heat/solvent-welded membrane materials, as well as installation procedures. Deals with loose-laid and ballasted, mechanically attached and fully adhered systems. Includes roof details.	20 min.
712	NRCA	THE SINGLE-PLY MEMBRANE: Provides an introduction to the single-ply roof membrane, including EPDM, thermoplastic and uncured elastomers. Covers installation procedures and flashing details for loose-laid and ballasted, partially adhered and fully adhered systems	20 min.
714	NRCA	Re-roofing with Protected Membranes	
715	Hi-Tuff	THE STEVENS HI-TUFF STORY – a marketing tape developed to explain the overall concept and benefits of Hi-Tuff single-ply, hypalon-based roofing system.	



718 Hi-Tuff HOT-AIR WELDING – this tape examines how to set up and operate the six common hot-air welders as well as clearly explaining the three most important factors to assure good automatic welding and the highest quality seams

800 -	STEEP (ASPHALT, CEDAR, TILE, METAL)		
VIDEO	PRODUCED BY	SUBJECT	LENGTH
801	GAF	A Personalized Video on Residential Roofing Timberline Class "A" Asphalt Shingles	5 min.
802	IKO	Re-roofing	30 min.
803	FLORIDA RFG CONTR. ASSOC.	PRIDE – Module 2: Steep Roofing S/M and A/C	24 min.
804	CEDAR SHAKE AND SHINGLE BUREAU	Pressure Impregnated Fire-Retardant Wood Shakes/Shingles	60 min.
807	CHH ROOFING INTERNAT'L	Decra Systems – Installation	15 min.
809	IKO	Blueprint for Roofing: Easy Step by Step Guide	
810	CEDAR SHAKE AND SHINGLE BUREAU	They Work, They Last	8 min.
811	CEDAR SHAKE AND SHINGLE BUREAU	Guide to Cedar Roofing	15 min.



900 VIDEO	- PRODUCED BY	GENERAL (ROOFING RELATED) SUBJECT	LENGTH
901	RIEI-5 (VC5)	DESIGN AND SPECIFICATION OF ROOFING SYSTEMS: Illustrating basic components and design considerations for both Built-up Roofing and Single Ply Roofing systems. Good film for public viewing in chapter meetings	25 min.
902	NRCA	ROOF MEMBRANE SYSTEMS: Provides an overview of the membrane systems commonly used for low-slope commercial and industrial roofing. Includes a general review of the roof system and covers built-up, modified bitumen, single-ply, and cold-applied membranes. Deals w/material, design and application considerations and systems selection criteria	23 min.
903	TRAINING A	Roof Membrane Systems	23 min.
		The Modified Bitumen Membrane	15 min.
		Design and Spec. of Roofing Systems	25 min.
		A Guide to Safety	20 min.
904	TRAINING B	FIBREGLASS PermaSeal – Modified Bitumen	18 min.
		Carisle EPDM	16 min.
		Dow Roofmate	38 min. 6 min.



905	NRCA	<p>ROOFING FOR THE COMMERCIAL/INDUSTRIAL BUYER: The sales tool needed by contractors to influence their customers' final buying decision. It takes new business prospects up on the roof and focuses on the many problems that can result from improper workmanship. Reviews built-up and single-ply membrane applications, flashing details and drainage considerations. Show your customers the difference a professional contractor can make.</p>	10 min.
906	RIEI-6	<p>Basic Membrane Roofing Application 000 Deck Preparation 840 Attachments 980 Vapour Retarders 1190 Thermal Insulations 1130 Roof Membranes (Mixed sequence of Mod Bit, PVC, EPDM, BUR) 3560 Surfacing 3930 End</p>	
908	NRCA	<p>ROOF CONSTRUCTION DETAILS: Provides an understanding of the principles of good roof flashing details through examination of NRCA – recommended detail plates. Covers drains, roof edges, walls, curbs, vents, pipes, expansion joints and air-handling units. Includes flashing for built-up modified bitumen, EPDM and PVC membranes</p>	20 min.
909	NRCA	<p>ROOF MEMBRANE SYSTEM: Provides an overview of the membrane systems commonly used for low-slope commercial and industrial roofing. Includes a general review of the roof system and covers built-up, modified bitumen, single-ply, and cold-applied membranes. Deals with material, design and application considerations and systems selection criteria.</p>	

1000 - MISCELLANEOUS

VIDEO	PRODUCED BY	SUBJECT	LENGTH
1002	SARNAFIL II	She Sarnafil Advantage 12 x 10 min. Marketing presentation	120 min.
1015	NRCA	Water Damage: Don't Get Soaked	14 min.
1023	SOPREMA	Sopralene Antirock: Waterproofing for Parking Decks and Bridges	7 min.
1024	SOPREMA	Soprasedal –Air Barrier	6 min.
1025	IRON WORKERS LOCAL 97	Trade Improvement: 1. Tying Knots 2. Select an Care of Rigging 3. Rigging Wire Rope Slings 4. Shore Up and Live	

Suggested Texts

N/A



Instructor Requirements

Occupation Qualification

The instructor must possess:

- BC Certificate of Qualification preferably with a Red Seal Endorsement.
- Certificate of Qualification from another Canadian jurisdiction complete with Red Seal Endorsement only.

Work Experience

A minimum of 5 years' experience working in the industry as a journey person

Instructional Experience and Education

It is preferred that the instructor also possesses one of the following:

- An Instructors Diploma or equivalent
- A Bachelor's Degree in Education
- A Master's Degree in Education



Appendix A

Assessment Guidelines



Program: **Roofer (Roofer, Damp and Waterproofer)**

Training providers delivering Roofer (Roofer, Damp and Waterproofer) apprenticeship in-school technical training are required to enter the following information in ITA Direct Access (ITADA) for each apprentice:

- An in-school mark in the form of a percentage

Training Provider Component: **In-School Technical Training**

The in-school mark for each level is derived from a combination of theory and practical assessments. This mark is then combined with the ITA Standard Level Examination to determine a final mark for the level.

Calculation tables showing the subject competencies, level percentage weightings and level examination weightings are shown in the *Grading Sheet: "Subject Competencies and Weightings"* section at the end of this document.

Roofer Level 1 & 2 in-school marks are calculated by:

- Totaling the level *theory* competency results as noted in the competencies and weightings tables and multiplying the total by 70% for Level 1 & 2 to produce a weighted theory result;
- Totaling the level *practical* competency results as noted in the competencies and weightings tables and multiplying the total by 30% for Level 1 & 2 to produce a weighted theory result;
- Adding the theory and practical competency results together to determine the final in-school result.

ITA Component: **ITA Standardized Level Examinations – Roofer Level 1 & 2**

ITADA automatically calculates the final mark for a level once the in-school training and standard level exam marks are entered into the system. This mark is calculated by blending the standardized exam percentage score and the in-school technical training percentage score to determine the final mark for the level.

In-school technical training (combined theory & practical) is weighted at 80% and the ITA standardized exam is weighted at 20%. These two scores are combined to determine the final level mark. This result is the final mark that is recorded in ITADA.

- A mark of 70% or greater is required to pass a level when combining the final in-school percentage score and the final ITA standardized level exam percentage score.

**Roofer Level 3 - Examinations**

Until further notice, apprentices taking Roofer Level 3 will write the Roofer Interprovincial Red Seal Examination as the final examination for the Roofer program.

The instructor is responsible for calculating and reporting the final mark for Level 3 to ITADA.

Refer to the *Grading Sheet Subject Competencies and Weightings* Level 3 table at the end of this document to determine the calculation process for completing the Level 3 in-school final mark.

In order to be eligible to write the Interprovincial Red Seal Examination, apprentices must receive a Level 3 in-school technical training final mark of 70% or greater.

Interprovincial (Red Seal) or ITA Exam

In order to achieve certification, Roofer apprentices are required to write the Roofer Interprovincial (Red Seal) exam after completing all levels of in-school technical training. Apprentices must have passed all levels of the Roofer program or be approved challengers to sit the exam.

A score of 70% or greater is required for a pass on the Interprovincial Red Seal exam.

Interprovincial (Red Seal) exams should be requested by training providers via the usual ITA procedure.

The ITA will administer and invigilate Interprovincial (Red Seal) exams and score and record exam results in ITADA.



Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING: ITA DIRECT ACCESS CODE:		ROOFER (ROOFER, DAMP AND WATERPROOFER) LEVEL 1 0104RO	
LINE	TRAINING TOPICS & SUGGESTED TIME ALLOCATION	THEORY WEIGHTING	PRACTICAL WEIGHTING
A	Use Safe Work Practices	17%	0%
B	Use Tools and Equipment	18%	0%
C	Use Documentation	7%	0%
D	Organize Work	20%	0%
E	Prepare Roofs	3%	0%
F	Install Low Slope and Flat Roofing	20%	0%
G	Install Steep Roofing	15%	0%
	Total	100%	100%
Calculated by the Training Provider Roofers (Roofers, Damp and Waterproofers) in-school theory & practical subject competency weighting		70%	30%
Training Provider enters final in-school mark into ITA Direct Access		X%	

Calculated by ITA: In-school Mark ITA Direct Access calculates the percentage weighting once the in-school mark is entered. Combined theory and practical subject competency multiplied by	80%
Calculated by ITA: Standard Level Exam Mark ITA Direct Access will calculate the percentage weighting once the standard level exam marks have been entered. The exam score is multiplied by	20%
Calculated by ITA: Final Mark The final mark for determining credit is calculated by ITA Direct Access.	FINAL%



PROGRAM: IN-SCHOOL TRAINING: ITA DIRECT ACCESS CODE:		ROOFER (ROOFER, DAMP AND WATERPROOFER) LEVEL 2 0104RO	
LINE	TRAINING TOPICS & SUGGESTED TIME ALLOCATION	THEORY WEIGHTING	PRACTICAL WEIGHTING
A	Use Safe Work Practices.	12%	0%
C	Use Documentation	13%	0%
D	Organize Work	11%	0%
F	Install Low Slope and Flat Roofing	37%	0%
G	Install Steep Roofing	21%	0%
I	Apply Waterproofing and Damp-proofing	6%	0%
	Total	100%	100%
Calculated by the Training Provider Roofers (Roofers, Damp and Waterproofers) in-school theory & practical subject competency weighting		70%	30%
Training Provider enters final in-school mark into ITA Direct Access		X%	

Calculated by ITA: In-school Mark ITA Direct Access calculates the percentage weighting once the in-school mark is entered. Combined theory and practical subject competency multiplied by	80%
Calculated by ITA: Standard Level Exam Mark ITA Direct Access will calculate the percentage weighting once the standard level exam marks have been entered. The exam score is multiplied by	20%
Calculated by ITA: Final Mark The final mark for determining credit is calculated by ITA Direct Access.	FINAL%



PROGRAM: IN-SCHOOL TRAINING: ITA DIRECT ACCESS CODE:		Roofer (Roofer, Damp and Waterproofer) LEVEL 3 0104RO	
LINE	TRAINING TOPICS & SUGGESTED TIME ALLOCATION	THEORY WEIGHTING	PRACTICAL WEIGHTING
A	Use Safe Work Practices	8%	0%
C	Use Documentation	7%	0%
D	Organize Work	7%	0%
F	Install Low Slope and Flat Roofing	58%	0%
G	Install Steep Roofing	10%	0%
H	Assess and Maintain Roofs, Damp and Waterproofing	10%	0%
	Total	100%	100%

Calculated by the Training Provider:		
Roofer (Roofer, Damp and Waterproofer) in-school theory & practical subject competency weighting	70%	30%
Training Provider enters final in-school mark into ITA Direct Access Apprentices must achieve a minimum 70% final in-school mark to be eligible to write the Interprovincial Red Seal exam.	IN-SCHOOL FINAL %	

All apprentices who complete Level 3 of the Roofer (Roofer, Damp & Waterproofer) program with a FINAL level mark of 70% or greater will write the Interprovincial Red Seal examination as their final assessment.

ITA will enter the apprentices' final examination mark in ITADA. A minimum mark of 70% on the examination is required for a pass.